2012 UWCA Field Guide

Field Guide – River Park to Boom Island Park Trip

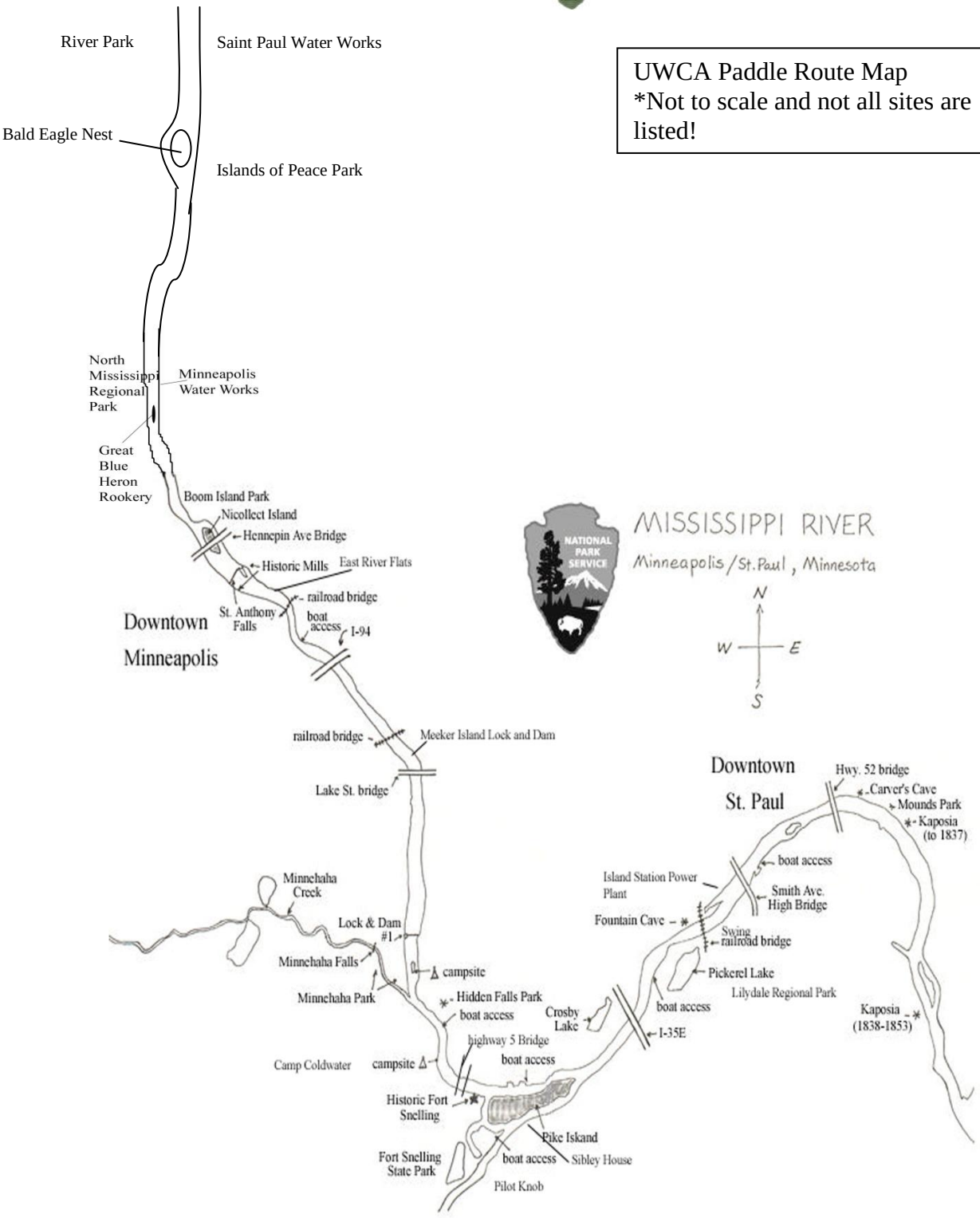
Welcome to the Mississippi National River and Recreation Area!

This field trip focuses on the student's connections to the Mississippi River. The river provides the water they drink, it has shaped events that built the city of Minneapolis, and it is home to a variety of wildlife. During the trip, please ask questions and encourage the students to make their own connections to the Mississippi River.

The following sights of interest are listed in the order of the paddle route:

- St. Paul Water Works
- Bald Eagles
- Islands of Peace Park
- Summer 2011 North Minneapolis Tornado
- Minneapolis Water Works
- North Mississippi Regional Park
- Shingle Creek Mouth
- Upper Harbor Terminal
- Riverside Power Plant
- Great Blue Heron Rookery
- Northern Metal Recycling
- Storm Sewers

The sight's locations are described based on the river mile markers (see picture on the right), which are found along the banks of the Mississippi River. The Army Corp of Engineers uses the markers as navigational tools. They measure the distance upstream from Cairo, Illinois.



UWCA Paddle Route Map
*Not to scale and not all sites are listed!

St. Paul Water Works

Location: River mile 862.8 – Left Descending Bank (left bank, as you head downstream).

Facts: Machinery in this large white building pumps water to Lake Charles. It then is distributed by the McCarron pumping station to St. Paul, Roseville and West St. Paul.

Questions:

- How are you tied to the St. Paul Water Works?
- Why is it important to keep the river water clean?
- Why do you think that the St. Paul Water Works is located along the Mississippi in Minneapolis, and not St. Paul?

Bald Eagles

Location: throughout the river, nesting near Islands of Peace Park (River mile 860.6-860.3)

Facts: It wasn't so long ago that seeing a bald eagle was a rare treat in the Twin Cities. Now, however, eagles are a more common site, in fact, a recent eagle survey found a total of 39 nests within the MNRRA! This is an increase over past surveys. Bald eagles have been making this great recovery since the ban of the pesticide DDT in 1971. Also, as the Mississippi River has been cleaned, allowing more fish and other food to be available to eagles. To further help their numbers, eagle pairs have been having more chicks. Typically an eagle pair has 1-2 chicks, but within MNRRA, nests have been found with 3 chicks and some even with 4. These high numbers and continuing increase of eagles is likely due to the reduction of pesticides like DDT and the high number of fish species within the Mississippi River. Recently a bald eagle pair moved into the Islands of Peace Park stretch of the river, so keep your eyes peeled!

Questions:

- What can you do to help bald eagles?
- What do you feel when you see these birds?
- Why do you think that the bald eagle was chosen as our national emblem?

Islands of Peace Park

Location: River mile 860.6-860.3

Description: The park's three islands spotlight a mature forest of maple-basswood trees. The wide walking bridge leads from the shoreline to Chase Island but the other two islands – Durnham and Gil Hodges – are accessible only by water. Durnham Island, which is straight west of Chase Island, can be a surprise to see due to the fluctuation of the water level. The third island, Gil Hodges, is the farthest upstream island.

Facts: Colonial nesting birds, especially herons, raise their young in this three-island area every year. It is also home to a pair of bald eagles. Occasionally during the spring, access is closed to the two more remote islands to protect the noticeable bird population.

Questions:

- Why do you think that birds nest on these islands?
- How do you think that these islands are affected by the water level?

Summer 2011 North Minneapolis Tornado

Location: Left and Right Descending Banks, River Mile 859.5

Description: On Sunday, May 22, 2011, a tornado struck North Minneapolis, killing one person and injuring 33 others. Power lines were downed, homes were damaged, and trees were blown over. The tornado's damage appeared to carry winds of 111 to 135 miles per hour and was the first to strike within the city of Minneapolis since a minor twister in south Minneapolis on August 19, 2009.

Before the tornado

Questions:

- Do you know anyone affected by this tornado?
- How do you think wildlife responded to the tornado?

After the tornado

Minneapolis Water Works

Location: River Mile 858.70 — Left Descending Bank (left bank, as you head downstream).

Description: Immediately across the river from North Mississippi Regional Park, you will see the large brick building with an intake area at the shoreline. This is the City of Minneapolis Water Works.

Facts: Here at the City of Minneapolis Water Works, about 28 billion gallons of water are pumped from the Mississippi River per year. The water is then treated though a disinfection, filtration, and sedimentation process. The clean water is delivered to Minneapolis and some surrounding cities for drinking water, sanitation, irrigation, and industrial purposes. Minneapolis consistently provides public water that meets higher standards than those set by local, state, and federal regulatory agencies. Approximately one million people in the Twin Cities metro get their drinking water from the Mississippi River. Minneapolis Water Treatment & Distribution Services produces an average of 57 million gallons of clean water per day. That's enough water to fill Lake of the Isles in about four days.

If you live in any of these areas, then you can see exactly where your water is coming from at this site.
Source: http://fieldguide.fmr.org/site_detail.php?site_id=40, and City of Minneapolis water works page (http://www.ci.minneapolis.mn.us/water/waterfacts.asp)

Questions:

- How does the water works connect you to the Mississippi River?
- What are some ways we can protect our source of drinking water?

Shingle Creek Mouth

Location: River Mile 857.90 — Right Descending Bank

Facts: Shingle Creek runs through the Camden Neighborhood in North Minneapolis. In 1910, Shingle Creek was straightened and classified as ditch #13. By 2004, the creek had lost almost all of its natural meandering quality. It is now classified as an impaired stream, which means that it does not meet state and federal standards for water quality.

The Shingle Creek Watershed Management Commission is now required to find out why and how the stream is so polluted. The watershed management district has been conducting studies and trying solutions. Salinification and run-off from city streets are some of the problems they have addressed. So far, the commission has held a conference and workshop about using less salt on the roads in the winter. They are experimenting with porous pavers, which drain rainwater to the river more gradually. Source: http://henry.mpls.k12.mn.us/A_Political_and_Environmental_Study_of_Shingle_Creek.html

Questions:

- Has anyone ever played or hung out in a creek or stream? How did you feel?
- What do you think about streams becoming polluted/impaired?
- How can you help to improve the water in places like Shingle Creek?

Upper Harbor Terminal

Location: River Mile 857.50-857.10 — Right Descending Bank

Facts: The Upper Harbor Terminal is the Port of Minneapolis. It is the northernmost point that the Army Corp of Engineers keeps open for navigation. The Army Corps of Engineers maintains at least a nine-foot channel in the river to this point. Many commodities may be present at this terminal, including grain, lumber, phosphate fertilizer, seed oil, steel, twine, paper, pipes, and salt. The igloo-shaped storage tanks are used for solids, and some tanks are insulated to keep products from freezing. The Upper Harbor Terminal is one of only four active barge facilities above the confluence of the Mississippi and Minnesota Rivers. According to its "Above the Falls Master Plan" Minneapolis' long-term plans for the property include converting the riverfront portion of the land to a new park, and redeveloping a portion of the land further from the river as housing. Furthermore, due to the desire to stop Asian carp from migrating up river the City of Minneapolis may close this port, negating the need to use the Saint Anthony Falls locks barges and thus reducing lockages which in turn reduce the possibility of Asian carp migrating upstream. Asian carp are invasive fish which disrupt the native aquatic ecosystem.

Source: FMR Field Guide: http://fieldguide.fmr.org/site_detail.php?site_id=60

Questions:

- How are barges and other boat traffic connected to you? (You eat some of the food they carry, or live in buildings made from materials they carry.)
- How do you think the river has changed to allow navigation and boat travel?

Riverside Power Plant

Location: River Mile 856.90 — Left Descending Bank

Facts: The Riverside Power Plant was originally built in 1911 and operated as a coal plant, by the Minneapolis General Electric Company. In 1916, Northern States Power Company took over ownership. Xcel energy now owns the plant, and in 2009, they switched from coal burning to natural gas energy. In the process, Xcel created a more efficient plant and reduced their emissions. This project reduced annual emissions from the site by around 99% of sulfur dioxide, 96% of nitric oxide and nitrogen dioxide, 86% of particulates, and 100% of mercury. Xcel changed their facility after legislation created incentives for conversion in 2001. This plant now produces about 439 megawatts of power, which is sufficient to power about 400,000 homes.
Source: FMR and Power Technology: http://www.power-technology.com/projects/riverside_chp/

Also several great blue herons have moved (following the tornado knocking down their old rockery) to the island next to the power plant. Several have re-built nests and are assumed to have laid and eggs. So keep an eye out for this!

Questions:

- How are you connected to the plant, and how is the plant connected to the river?
- Do you know anyone with asthma? (Discuss air quality issues, particularly from coal-powered plants and how this would make asthma worse.)
- What human actions affect what kind of power we use and how it is produced? (we were able to get clearer air quality largely due to political action---resulting from local activism)

Great Blue Heron Rookery

Location: River Mile 856.4 (New location of the Rookery)

Description: Look for Great Blue Herons flying to and from the rookery. They are large, blue-grey colored bids with long legs and necks. As you paddle by, you will see many heron nests in the trees, and hear sounds of their calls. NOTE: The rookery was destroyed in the May 2011 tornado, but the island downstream at the Riverside power plant has new nest building activity.

Great Blue Herons nest in rookeries. These groupings of nests are built atop trees on islands, which helps the birds to avoid predators. Great Blue Herons nest in groups because there is security in having several pairs of sharp eyes and pointy bills available for defense.

Facts: The Great Blue Heron is among the tallest herons in North America. Its wingspan can be up to 6 feet wide. Because of its long legs and neck and its sharp, serrated beak, the Great Blue Heron is well suited for catching fish. A patient hunter, the heron wades slowly in shallow water, where it finds crayfish, fish, small turtles, and frogs. The heron may also hunt for small animals and large insects on land.

Fun Fact: Many fish, such as perch and bluegills, are armed with sharp spines. To eat fish, blue herons turn their prey so it is swallowed head first. This depresses spines, usually located in the fins, against the fish's body and makes it less likely that the bird will be injured.
Source: NPS/miss site: http://www.nps.gov/miss/naturescience/birdsgrea.htm

Questions:

- How do birds connect you to the river?
- Why don't all birds nest in groups?
- How do you feel when you see these birds?
- What can you do to help these birds?
-

Northern Metal Recycling

Location: River Mile 856.3 --- Right Descending Bank

Facts: This is usually a very noisy facility on a noisy stretch of river making a good site to know about. The Northern Metal Recycling Company owns and operates the site as a metal recycling plant, where scrap metal is broken down into smaller pieces and then shipped down river to metal re-furbishing plant. On this site they handle most grades of bulk quantity commercial, industrial and demolition metal scrap.

According to Northern Metal's website their "fully-enclosed metal shredder installation here is the environmentally cleanest in North America; adjoining barge loading facilities enable direct access to global commerce via the Mississippi River. The 11-acre paved yard surface is sloped away from the river and all stormwater is diverted into a network of catch basins. Collected water is stored in large underground tanks for treatment and eventual use by ongoing operations. There is no groundwater infiltration or run-off into the Mississippi." (http://www.northernmetalrecycling.com/AmericanIronPage.html)

There was significant controversy over installation of a giant scrap-iron grinding machine from Germany called the "Kondirator." The city council issued a special use permit for the Kondirator in 1990 but then the city ordered a halt to the shredder in 1991. Nine years of litigation followed, ending with a permit for the shredder and a city payment of $8.75 million to the company (http://fieldguide.fmr.org/site_detail.php?site_id=71). Now the technology has changed and the Kondirator is no longer necessary but the cleaner environmental technology mentioned above resulted in part from the litigation.

Questions:

- Do any of the students recycle anything made of metal?
- What do they think about seeing a part of the metal recycling cycle?
- What do they think about the company's work to divert storm-water and groundwater from the Mississippi River?
- How is this different from what happens to most storm-water?
- Could the city, other companies, or their families could learn to deal with their storm-water better?

Old Grain Belt Brewery

(Currently houses offices and the Pierre Bottineau branch of the Minneapolis Public Library)

Location: River Mile 855.50 — Left Descending Bank

Facts: The Gain Belt Brewery was built between 1891 and 1892. By 1890, there were over 100 breweries in the state. Beer brewing took off in the area because of the abundance of barley, and the traditions of the German settlers. The barrels used in the brewery were made from logs sent down the river.

*Fun Fact: The people who made the barrels were called Coopers. Are any of the student's last names Cooper?

The library here is named for Pierre Bottineau, who was a Métis (pronounced "may-tee"). Bottineau was a fur company scout, messenger, settler, and land speculator. He was also a translator between English, French, Dakota, Cree, Ojibwa, Mandan, and Winnebago languages. He knew the land very well. In fact, it was once said that, "The vast Northwest lay like a map in his brain."

The Métis people were a mix of French Canadian and Native American, usually Ojibway or Cree. They often served as go-betweens between Europeans and Native Americans. Further down the river is the vintage sign for Grain Belt Beer, a Minneapolis icon, which is clearly visible from the river.

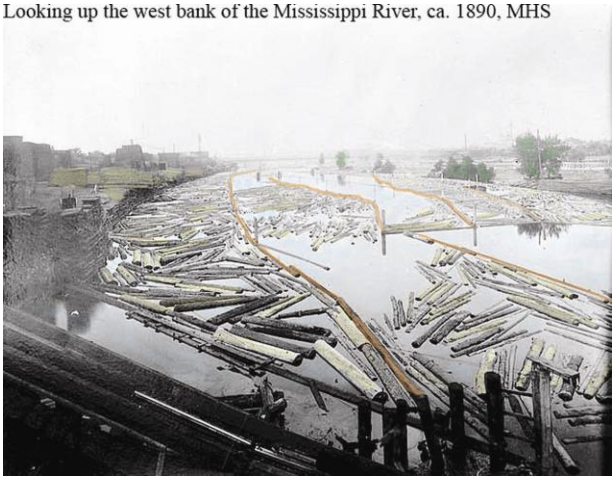
Questions:

- How many languages can you speak?
- Can anyone speak more than one, two, or three languages? Bottineau could speak seven different languages, which gave him an advantage in his travels.

River Booms

Location: Historically, booms were located all along the upper river, particularly for the purposes of lumber transport. Today, they are most often found near construction sites.

Looking up the west bank of the Mississippi River, ca. 1890, MHS



Description: River booms are used to contain or direct anything that floats in water. Historically, they were used in the logging industry to direct logs into the proper lumber mill. Booms are now primarily used to direct or contain sediment and/or pollution.

Historical Facts: About a hundred years ago, logs were floated from Northern Minnesota to these booms near downtown Minneapolis, which directed the logs to the company that owned them. Each log was branded by company name. Men known as “log drivers”, walked out onto the logs, separated the logs into the correct boom, and kept them moving downriver. This was a very dangerous profession, as log drivers could easily become caught under the logs. The area we are paddling through today would have been covered with logs during the 1890s. Lumbering was a significant part of the Minnesota economy and workforce from1860-1910. In 1899, Minneapolis was the number one lumber-milling city in the nation.

Source: Anginson Historical Study, Ch. 7

Current Use: Booms are used during construction, particularly bridge construction. This is why we see yellow booms by the Lowery Avenue Bridge construction site. Recently, booms have also been used to contain the oil spill in the Gulf of Mexico.

Questions:

- How does logging on the river connect to your life?
- How and where do you see booms used today?

Storm Sewers

Location: Throughout the Park

Facts: Storm sewers bring water, and anything contained in the water, from our city streets into the river. Anything dropped on the street, yards, or parks of Minneapolis may end up in the river without any treatment. Much of the pollution in the river results from this non-point source pollution. Some examples of the pollutants which end up in the river are oil and grease, construction site sediment, bacteria from animal waste, excess lawn fertilizer, pesticides, and organic material, and toxic metals (such as mercury and lead). A typical downtown city block produces about nine times more runoff than a wooded area of the same size, because of all of the hard (impervious) surfaces. (see the storm drain entry on p 32 for more detail on water pollution). Runoff from the streets is particularly noticeable after a rainstorm, when there is visible refuse in the river.

Questions:

- How do storm drains/sewers connect your life to the river?
- What can you do to help keep the river clean?

Field Guide- East River Flats route in the Mississippi River Gorge

Welcome to the Mississippi National River and Recreation Area!

This route travels through the Mississippi River Gorge, which was carved out by the recession of what were once giant waterfalls. The waterfall actually traveled from downtown St. Paul to modern day St. Anthony Falls. The recession of these falls are one of the natural features and forces we encounter. In addition to natural forces, we will also discuss the various ways that humans have impacted the river; for example, the storm sewers, the navigational channel and buoys, dams, bridges, and buildings along the gorge.

The following sights of interest are listed in order of the paddle route:

- Bald Eagles
- Navigational Aids: Buoys and Day-markers
- East River Flats Catwalk
- Bluffs, Rock Layers, and Waterfalls
- Dartmouth Bridge (I-94)
- Cappelen Memorial (Franklin Avenue) Bridge
- Short Line Railroad Bridge
- Sand Flats and Dredged Sands
- Meeker Island Lock and Dam
- Storm Water Drain Outfalls
- Under-river Pipes
- Floodplain Forest
- Beaver-gnawed Trees

Paddlers entering Hidden Falls Park

Bald Eagles

Location: throughout the river, nesting pair near Lake Street Bridge

Facts: It wasn't so long ago that seeing a bald eagle was a rare treat in the Twin Cities. Now, however, eagles are a more common site, in fact, a recent eagle survey found a total of 39 nests within the MNRRA! This is an increase over past surveys. Bald eagles have been making this great recovery since the ban of the pesticide DDT in 1971. Also, as the Mississippi River has been cleaned, allowing more fish and other food to be available to eagles. To further help their numbers, eagle pairs have been having more chicks. Typically an eagle pair has 1-2 chicks, but within MNRRA, nests have been found with 3 chicks and some even with 4. These high numbers and continuing increase of eagles is likely due to the reduction of pesticides like DDT and the high number of fish species within the Mississippi River. Recently a bald eagle pair moved into the Islands of Peace Park stretch of the river, so keep your eyes peeled!

Questions:

- What can you do to help bald eagles?
- What do you feel when you see these birds?
- Why do you think that the bald eagle was chosen as our national emblem?

Navigational Aids: Buoys and Day-markers

Location: Found throughout the river

Figure 1: A green "can" buoy

Buoys and Day-markers:
Buoys and day-markers act as traffic signals that guide watercraft operators safely along waterways. They also identify dangerous or controlled areas and give directions and information. These navigational aides are used in the U.S. Aids to Navigation System (ATON). The Mississippi River and its tributaries above Baton Rouge use a variation of ATON, called the Western Rivers Marking System.

Figure 2: A red "nun" buoy

Colors and numbers on these navigational aides have the same meaning, regardless of the kind of buoy or marker on which they appear. Buoy shapes include “nun” (cone shaped, red, and with even numbers) and “can” (green, cylindrical, and with odd numbers). Red buoys mark the edge of the channel on the starboard (right) side as you enter from open sea or head upstream. Green buoys mark the edge of the channel on your port (left) side as you enter from open sea or head upstream. Green buoys have odd numbers and red buoys have even numbers, which increase consecutively as you head upstream.

Day-marks have the same role as buoys. They are permanent signs attached to posts or other structures. Common day-marks are red triangles (equivalent to nuns) and green squares (equivalent to cans). On the Mississippi River, day-marks are not numbered, but they have an attached mile marker board that indicates the river mileage upstream from Cairo, Illinois (the mouth of the Ohio River). When using these navigational aids on the Mississippi, remember this phrase as a reminder of the correct course when returning from open waters or heading downstream: “Red Right Returning.”
(source: http://www.takemefishing.org/boating/boating-basics/navigation/buoys-markers,

Figure 3: A "day-marker"

http://files.dnr.state.mn.us/education_safety/safety/boatwater/miss_river_guide/mrg_boating_big_river.pdf).

Questions

- How did people navigate the river prior to buoys and daymarks?
- How did the invention of navigational aides assist in improving river commerce and recreation?

East River Flats Catwalk

Location: River Mile 851.6 to 852, left descending bank

The Catwalk:
East River Flats Park is part of the Minneapolis Park and Recreation Board. The park is situated below 25-foot limestone bluffs, and lies upon relatively flat deposits on the inner side of a large bend in the river set just below the University of Minnesota. The catwalk was constructed to allow visitors to safely traverse a section of the river where erosion and rock slides made an older path unusable.

East River Flats Catwalk. Image from http://www.johnweeks.net/bridges/pages/b18.html

Questions:

- How does a catwalk or other similarly engineered structure provide easy access for visitors?
- What are some other methods for providing access to otherwise inaccessible areas?
- Do you think the construction of a catwalk or other engineered structure harms or minimizes human impact on an environment?

Facts:
The undeveloped areas of the Mississippi River Gorge have a number of trails running though them. The area under the Dartmouth Bridge is very narrow, and is prone to rock slides. When the Dartmouth Bridge was rebuilt, a rock slide made the existing path unusable. To fix the problem, the Minneapolis Parks Department had a prefabricated bridge installed to run along the river shore in 2008. This allows the trail to safely traverse the unstable area, and it makes the trail safe at high water (when there is almost no space between the rock face and the river).The catwalk, as it is called, runs from the East River Flats Park south to near the Cappelen Memorial Bridge at Franklin Avenue. It is accessible to both bikes and pedestrians.
(Souce: http://www.johnweeks.com/bridges/pages/b18.html).

Dartmouth Bridge (I-94 Mississippi River Crossing)

Location: River Mile 852.70, both sides

Dartmouth Bridge:
The Dartmouth Bridge (I94) is a box girder bridge that spans the Mississippi River in Minneapolis between the Cedar-Riverside area and the University of Minnesota Campus area. It was built in 1964. The bridge has a basic design when compared to other Mississippi River bridges in the vicinity, but it is very funtional.

The Dartmouth Bridge carries more vehicles than any other bridge in the state (167,000 vehicles daily) on I-94 between downtown Minneapolis and Saint Paul. It was reconstructed in the mid-90s to add lanes and increase traffic capacity. This reconstruction was done without shutting the bridge down. This is quite a feat of engineering when you consider that this is the busiest highway bridge in the state of Minnesota, and the busiest highway bridge anywhere on the Mississippi River.
(From http://www.johnweeks.com/bridges/pages/ms13.html).

Questions:
Notice the different bridges we pass under today and think about the following questions:

- Which bridge do you like best?
- Which aspect of architecture is most important (structure, function, appearance, etc.), and why?
- What causes bridges to collapse?
- How do bridge designers design bridges to address traffic needs?

Cappelen Memorial (Franklin Avenue) Bridge

Franklin Bridge. From http://www.johnweeks.com/bridges/pages/ms12.html

Location: River Mile 851.50, both sides

Facts: The original Franklin Avenue Bridge was constructed in 1889 for pedestrians and wagons. The bridge was rebuilt between 1919 and 1923. When the bridge was completed in 1923, it featured the single longest concrete arch span in the world at 400 feet. It was refurbished and modernized between 1971 and 1973. The Cappelen Bridge was added to the National Register of Historic Places in 1989. Frederick W. Cappelen is one of the great names from the golden age of bridge building. As an engineer for the City of Minneapolis, Cappelen designed many of the monumental bridges from the early 20th century. He passed away during the construction of the Franklin Avenue Bridge, so it is named in his honor as a tribute.

The Cappelen Bridge saw little maintenance during its early life. But by 1970, the Cappelen Bridge was in such poor shape that it had to be closed down. The bridge was stripped down to its main arches and rebuilt from 1971 to 1973. Two pier remnants from the original 1889 bridge remain. Engineers calculated that the original bridge was overbuilt, and needed only half as many vertical supports. The horizontal stringers were built wider, and a 4-lane deck with wide sidewalks was installed. The bridge now looks more streamlined as a result.

Pier from original 1889 Franklin Ave. Bridge

Questions:

- Again, how do you feel passing under this bridge?
- What do you think of the design?
- In your opinion, which aspect of architecture is most important (structure, function, appearance, etc.) and why?
- How long should a bridge last?

Short Line Railroad Bridge

Location: River Mile 850.70, on both banks

Short Line Railroad Bridge:
This railroad bridge was built during a time of major railroad expansion (1879-1880). Instead of using rivers for transportation, railroads were becoming the dominant method for moving people and goods. Railroads could be built virtually anywhere, and they were a fast mode of transport. Railroads were versatile serving both long and short distance transportation needs.

The bridge is located at the eastern end of the Midtown Greenway. Some people hope the bridge could someday serve as the river crossing for this route, but today it is still used for only for rail traffic.

Facts:
By the late 1870s, there was the need to make a shorter rail connection between Minneapolis and Saint Paul. Thus, the so-called "Short Line" was created. The Chicago, Milwaukee, and Saint Paul Railroad laid track for the Short Line to the river (roughly parallel to 27th Street) in the late 1870s, and the Short Line Bridge was completed in 1880. Fourteen stories tall and 1,000 feet long, it was one of the first bridges to span the river south of downtown. In 1901, the bridge was widened and rebuilt to accommodate 3 tracks. It carried both freight and passenger trains, such as the famous Olympian passenger train. Passenger rail service stopped in 1971, but several freight trains still use the bridge to service to the grain elevators on Hiawatha Avenue, their primary customers. The Canadian Pacific Railroad currently owns the bridge and rail corridor and leases it to the Minnesota Commercial Railroad.
(From FMR- http://fieldguide.fmr.org/site_detail.php?site_id=161)

Questions:
- What are some modes of transport that have replaced railroads?
- What advantages do railroads have over rivers when travelling? What about rivers over railroads?

Sand Flats and Dredged Sand

Location: River Mile 850.30, left descending bank, and 851.50, both sides

Facts: Sedimentation in the Mississippi River channel is caused by the normal cycle of silt movement, erosion from high water or heavy rains, and changes in river currents. This natural cycle of sedimentation has been altered by human activities. Agricultural and home fertilizers, urbanization, and the redirection of streams that feed into the river have added to the sediment and turbidity of the waters.

To maintain the 9-foot navigation channel for boats, excess material that settles in river bottom must be removed. Mechanical or hydraulic dredging are methods used for removal. The navigation channel is kept up for 243.6 miles on the Mississippi, and also on the St. Croix River, the Minnesota River, and Black River tributaries.

Dredged material is removed by the Army Corps of Engineers, and it is placed in designated areas along the river. Some of these areas are “beneficial use” placement areas. Common beneficial uses of dredged material in the St. Paul District are upland habitat development, wetland creation, aquatic habitat enhancement, creation of areas for bird nesting, beach nourishment, winter road maintenance, levee repair and improvement, aggregate for concrete, lining fly ash pits, bank protection, and general purpose fill.

Dredged material placed on beaches has been tested to ensure it is safe from harmful chemicals.

The navigation project is achieved primarily by a series of locks and dams. Channel maintenance consists of dredging, the use of channel control structures (wing dams, closing dams, and bank revetment), snag removal, accurate channel marking, and close monitoring of river conditions. Since 1985, 840,000 cubic yards are dredged annually (an Olympic sized swimming pool holds around 3,000 cubic yards) from 28 locations around St. Paul.

Questions:

- Does removing sand from the river pose environmental issues?
- How often does the river navigation channel need to be dredged?
- Are there locations on the river than need dredging more frequently than others?

Meeker Island Lock and Dam

Location: River Mile 850.30, left descending bank

Facts: By the early 1890s, the Army Corps of Engineers had devised a plan to build two low dams with locks, which would raise the level of the river sufficiently enough to make navigation to St. Anthony Falls possible. One dam would be near Meeker Island (just south of the Short Line railroad bridge), and the other was built near the mouth of Minnehaha Creek, which is known as Lock and Dam #1.

Construction on the Meeker Island Lock and Dam started in 1898, and took nearly a decade to finish. It was completed in 1907. This lock and dam operated for only 5 years before it was partially demolished. A new, high dam was completed to the south, and the the Meeker Dam was destroyed to regulate water levels. The old lock is still visible during low water on the St. Paul side, but the bear trap gates on the Minneapolis side of the River (once used to send logs down the river), have disappeared under the white sand dredge spoils that are deposited there.

Meeker Dam.
From http://www.johnweeks.com/bridges/pages/meeker.html

To avoid confusion with the current Lock & Dam #2 near Hastings, MN, the old Lock & Dam #2 is now generally called the Meeker Island Lock & Dam. Every so often, low water on the Mississippi River exposes part of the old lock structure. One such occasion was in August, 2007, following the I-35W bridge collapse, when the US Army Corps of Engineers drew down the Ford Dam pool by 2 feet to aid in the search and recovery operation.

(Source: http://www.johnweeks.com/bridges/pages/meeker.html).

Questions

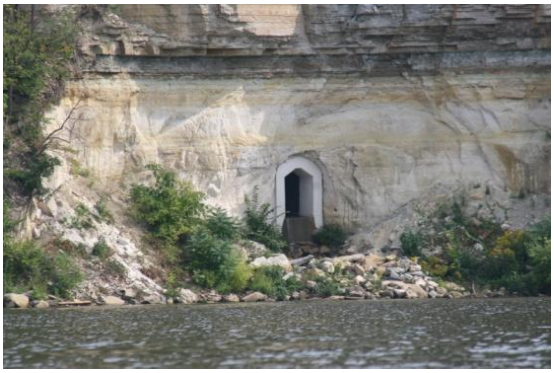
- How do locks and dams enable river traffic to navigate the river?
- What are some of the impacts a lock and dam system can have on a river's environment?
- Why are dams sometimes necessary?

Storm Water Drain Outfalls

Location: Throughout the gorge

Facts: Storm water originates from precipitation, snowmelt, or agricultural and home runoff. Storm water that does not soak into the ground becomes surface runoff, which flows directly into surface waterways or is channeled into storm sewers. This water eventually ends up in the rivers and lakes. Storm water is of concern for two main issues: volume and timing of runoff water, and water pollution. Storm water runoff flows into storm drains through catch basins (storm drain inlets), which are located in city streets. Collected storm water runs through a series of tunnels that lead to the Mississippi River. The catch basins are critical to controlling runoff, so they should not be clogged, and nothing but storm water should be put into them. In Minneapolis, there are over 509 miles of storm drains and 12 miles of deep storm tunnels under the streets. In St. Paul, the city storm water system includes 450 miles of sewers.

Storm water runoff flows off hard surfaces such as roofs, driveways, parking lots, and streets and moves into storm drains. Examples of pollutants that collect on hard surfaces are oil and grease, construction site sediment, bacteria from animal waste, excess lawn fertilizer, pesticides, leaves and grasses, and toxic metals (such as mercury and lead). A typical downtown city block produces about nine times more runoff than a wooded area of the same size, because of all of the hard (impervious) surfaces. Rainwater washes the hard surfaces, and the runoff carries these pollutants directly to nearby streams, rivers, and lakes.



Storm water brings visible pollution like trash, but also harder to detect pollution like chemicals and even excess organic matter (grass, leaves, braches etc.) which release phosphorus into the water. Phosphorous is a nutrient which spurs plant growth including algae. 5 trash bags of organic matter = 1 pound of phosphorus, which can lead to 1000 pounds of algae. Bacteria break algae down but after eating all the algae they die and decompose. Their decomposition uses the oxygen in the water which fish, turtles, and all aquatic life needs.

To prevent runoff, replace lawns with long grasses, shrubs, and trees. These plants absorb and filter water better than regular grass. Rake leaves and excess organic matter and place it in bags for pick-up by the city to prevent it from entering the water system. Using porous pavers for streets and sidewalks also reduces the problem of runoff. Rain barrels are another method for catching runoff; the barrels save extra storm water for use in a garden.

Questions:
What do you think/feel when you see the storm sewer?
Do you care if the river becomes polluted, and why would you?
What are some easy steps to prevent pollution from entering the river?
How does pollution affect river life?
Once a river is contaminated, how can it be cleaned up?
Think back to our last big storm, did you see any streets that were flooded?
(Source: http://www.ci.minneapolis.mn.us/stormwater/, http://www.stpaul.gov/index.aspx?nid=2686).

Under-River Pipes and Pump Station

Location: River Mile 850.30, right descending bank, before the boathouse and after the sand flats

Facts: Around 1870, the earliest known sewers in the City of Minneapolis were constructed. Today, there are over 830 miles of sanitary sewers and 31 miles of sanitary main and interceptor tunnels under Minneapolis streets.

Over 100,000 buildings in Minneapolis create about 60 million gallons of wastewater per day. A typical 25 yrd. public swimming pool contains 84,000 gallons of water so every day we use enough water to fill 700 swimming pools. The water runs through the sewer system to the Metropolitan Council Environmental Services (MCES) Pig's Eye sewage treatment plant in St. Paul. Fees paid to MCES go towards maintaining its regional collection system and the costs of wastewater treatment.

Sewers usually flow downhill, using gravity to move the wastewater along. Sewer mains often follow streams, which also flow downhill. The main tunnel from Minneapolis to MCES follows the Mississippi River. When gravity doesn't work, pump stations force the wastewater to a higher level, where gravity is able to take over again.

When the wastewater reaches MCES, several steps are taken to treat it. First, wastewater passes through a large iron grate to remove large items. After that, the solids are settled out, collected, and incinerated. Bacteria are used to remove organic materials and nutrients, after which the bacteria are settled out. Finally, phosphorus and nitrogen are removed, and a small amount of chlorine is added. After all of these steps, this water is safe for us to drink and use.

Pump Station just past the first sand flats on the route

(source: http://www.ci.minneapolis.mn.us/stormwater/, http://www2.metrocouncil.org/environment/WastewaterTreatment/Metro.htm)

Questions

- How does it smell around the sewer area?
- How does wastewater from my house get to the treatment plant?
- What other methods are available for treating wastewater?
- How does wastewater that enters the river affect the ecosystem?

Floodplain Forest

Location: Throughout the river

Facts: Floodplain forestland is valuable to the river. The vegetation and microorganisms that live in these forests serve as water absorbing and filtering systems. Instead of flowing directly to the river, the water is able to infiltrate into the soil. Infiltration is improved because of the large root systems the vegetation provides. Most of the vegetation along the river has been lost, but the remaining floodplain forest continues to fulfill an important role in improving water quality. Water which enters the river from a floodplain forest is much cleaner than water from storm sewers because it has gone through this filtering process.

The ability of forests to produce clean water declines as they are depleted or reduced in size. Thus, the loss of forestland seriously impairs water flow and quality, ecological health and diversity, and some economic and recreational water use. The Upper Mississippi River watershed experienced rapid loss of forestland in the late 1800s through the early 1900s. Since then, deforestation is most common in high-growth areas. Trends in forest ownership show a continuing trend towards smaller tracts, which will likely have a negative impact on water quality.

Lowland deciduous forest habitats occur within floodplains like this one. Floodplain forests are seasonally wet forests; they flood in the spring after the snowmelt or after a heavy rain. These forests are found on sandy or silt-laden alluvium (fertile soil deposited by flowing water). These forested areas are an interface between terrestrial and aquatic ecosystems.

The canopy of floodplain forests are dominated by deciduous trees that are tolerant of saturated soils, prolonged inundation, frequent erosion, and sediment deposition. Less tolerant plants will grow on terraces, which flood only occasionally. In this area, silver maple, black willow, and cottonwood trees are the most dominant.

Source: http://files.dnr.state.mn.us/assistance/nrplanning/bigpicture/cwcs/habitats/03.pdf

Questions:

- Do you think there was more forest land before humans arrived?
- How do you think modern human land-uses, such as sewers and concrete have affected water quality?
- How can we work to improve water quality within the modern context?
- How does a forest “clean up” water and improve watershed health?
- Can a habitat be “restored” to its original condition?
- Why does the destruction of floodplain forest have an impact on birds?
- What are some ways to prevent destruction of floodplain forests?

Beaver-Gnawed Trees

Location: Throughout the river, look for the beaver lodge about .5 miles south of Lake Street bridge and notice all the beaver chewed trees around the large sandy flats area.

Beaver gnawed trees. From http://en.wikipedia.org/wiki/File:Beaver_signs.JPG

Facts: The Mississippi River Valley provides habitat for both aquatic and terrestrial animals. Mammals (including river otter, beaver and fox) are found in within the area. Recently evidence of river otters moving into the Snelling Lake and other sections of the river have been found. The Park is currently investigating how many otter individuals are present. Evidence of the beaver (gnawed trees) can be seen throughout the river. Although humans have developed much of their natural habitat, beavers have adapted to change.

Beavers use their powerful front teeth to cut trees and plants for building and food. They are known for their "lodges," their wooden homes found in rivers, ponds, and streams. They also build canals to float building materials that are difficult to haul over land. In the absence of ponds, beavers must construct dams before building their lodges. First they secure vertical poles. The beavers then fill the open spaces with horizontally placed branches. They close the gaps with weeds and mud until the dam impounds sufficient water to surround the lodge.

Beaver Life in The Winter
Beavers do not hibernate in winter. Instead, they store sticks and logs in a pile in their ponds. They eat the under-bark of the sticks until spring comes. Some of the pile stays above water and accumulates snow in the winter. This insulation often keeps the water from freezing around the food pile, which provides a location for beavers to breathe when outside of their lodge.

The beaver works as a keystone species in an ecosystem by creating wetlands that are used by many other species. Under their direction, a small stream flowing through a wooded valley will become a pond edged with second-growth forest. Eventually, if the beavers live there long enough, the pond will fill in with detritus and soil, becoming a fertile meadow. This activity is a direct consequence of the ecological niche that beavers occupy.

When startled or frightened, a swimming beaver will dive and slap the water with its broad tail. This sound is audible over great distances, and it serves as a warning to other beavers. Once a beaver has sounded the alarm, nearby beavers dive and may not reemerge for some time. Beavers are slow on land, but are good swimmers that can stay under water for as long as 15 minutes.
(Source: http://www.gpnc.org/beaver.htm,http://en.wikipedia.org/wiki/Beaver).

Field Guide- Hidden Falls to Harriet Island

Welcome to the Mississippi National River and Recreation Area.

This field trip focuses on the confluence area of the Mississippi and Minnesota Rivers. This area is of cultural and historic significance to the Dakota Indian people and Euro-Americans. On the trip, encourage students to think about different cultural interactions and how the geography of the place has influenced human actions in the area.

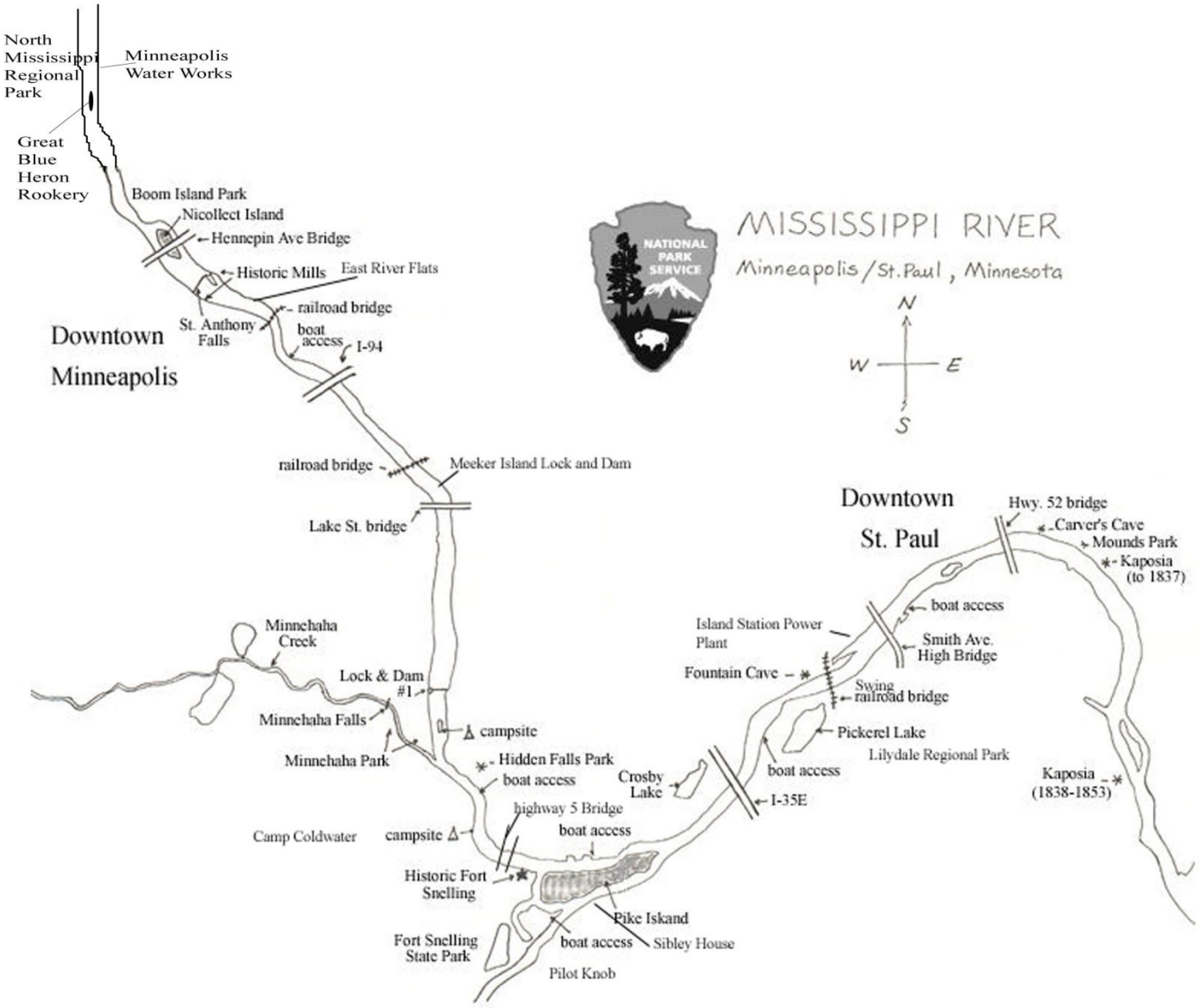
Sights of interest are listed in the order of the paddle route:

- Camp Coldwater and Baker Trading Post and St. Louis Hotel
- Fort Snelling and Fort Snelling State Park
- Pike Island
- Dakota Prison Camp
- Sibley House
- Pilot Knob
- Highway 5 Bridge

The sight's locations are described based on river mile markers (picture on right), which are found along the banks of the Mississippi River. The Army Corp of Engineers uses the markers as navigational tools, they measure distance upstream from Cairo, Illinois. This is the boundary of the upper section of the Mississippi River.

Urban Wilderness Canoe Adventures (UWCA)
Paddle Route Map

***note scale is not perfect and not all sites are listed!**



Mni Owe Sni: Camp Coldwater, Baker Trading Post, and St. Louis Hotel

Location: River Mile 845.40, right descending bank, across the river and less than ½ mile downstream from Hidden Falls.

Description: This is the site of a camp below Fort Snelling, which was built along a coldwater spring. It is now a dog park. The area where the spring is located now belongs to MNRRA. MNRRA is recreating a oak savanna here, day lighting the creek, and creating new trails.

This watercolor was created in 1856 by Alfred Sully, a soldier and artist who traveled to Minnesota with a military expedition that camped at Coldwater Spring. From the hotel in the Baker House, he viewed Fort Snelling with the Coldwater area in the foreground. Shown at bottom right is a group of tents and wagons.

Reproduced with permission of the Yale Collection of Western Americana, Beinecke Rare Book Library, Yale University.

Facts: By 1824, Fort Snelling was completed and soldiers had moved in. Colonel Snelling allowed refugees from the failed Selkirk colony in Canada to stay at the new camp. They constructed farms, buildings, and established the community of Camp Coldwater around a spring and to the northwest along the Mississippi.

Benjamin Baker located his fur trade post at this spring in the early 1830s. An 1837 map of Fort Snelling by Lt. E. K. Smith shows that more than 20 buildings comprised Camp Coldwater, including blacksmith shops, farms, a baker's post, and outbuildings. A census of the community tallied 157 individuals.

Baker's post may have been the only part of the early settlement that survived after 1840, when the commandant of Fort Snelling forced the squatters off the Fort Snelling military reservation. Baker's posts changed hands and uses over the next two decades, serving as a boarding house and as the St. Louis Hotel. In 1862 it burned down. *Source: FMR field guide, www.nps.gov/miss*

The refugees that Colonel Snelling allowed in the 1820s to stay and build farms at Camp Coldwater were staying on the military reservation because at this time all other lands in Minnesota were considered to belong to Dakota Indian people and Ojibwe people. Before the 1837 treaty, whites lived on reservations in Minnesota.

Questions

- Can you imagine living on the banks of the Mississippi without electricity or any modern amenities? What do you think it would be like?
- How do you think the Dakota people felt about these new settlements?

Fort Snelling

Location: River Mile 845.40, right descending bank, on the bluff.

Facts: Fort Snelling is located at the confluence of the Mississippi and Minnesota Rivers. For the United States, it was a strategic location. From Fort Snelling, it was possible to monitor and control boat traffic on both rivers, which would keep settlers out and regulate the important fur trade economy. For the Dakota Indians, the *b'dote* (confluence) was a sacred area, considered to be the center of the world. Thus, the group in control of *b'dote* held great power.

On September 21, 1805, Zebulon Pike arrived in the area. He signed a questionable treaty with the Dakota people for 100,000 acres of land in exchange for $200 worth of trinkets, a keg of whiskey, and the promise of a trading post. After a rough start the first winter of 1819-20, with many dying of scurvy due to malnutrition, Colonel Josiah Snelling took command of the 350 soldiers. He had them build the stone fort that still bares his name.

Fort Snelling soldiers had a give and take relationship with the Dakota people for the next decades resulting from trade back and forth and enough land and resources to go round. This relationship changed and gradually soured as the Dakota had less to trade and the Europeans wanted more and more land. This resulted in 1837 and 1851 treaties where Dakota gave up more lands. And eventually culminated in the 1862 war, where women and children were put in an internment camp and the men were brought to Mankato.
During the Civil War, Minnesota used the fort to train volunteers that wanted to join the Union Army. Later, the fort was expanded and used as a supply base for the Dakota Territory and as a training center for soldiers assigned to the Indian Campaigns, the Spanish American War, WWI, and WWII. *Source: http://www.nps.gov/miss/planyourvisit/histfort.htm, fmr field guide*

Questions:

- What are some strategic locations that the U.S. government still uses?
- Do the students have any special places that are like the *b'dote*?
- What was it like to live and work at Fort Snelling? (Later in the field trip, students will have the opportunity to ask a Fort Snelling solider.)
- What was it like for Dakota people to see newcomers develop their sacred land? (Later in the field trip, students will have the opportunity to ask a Dakota presenter.)
-

Fort Snelling State Park

Location: River Mile 847.6-844

Facts:

Not only does the *b'dote*/Fort Snelling area have an epic history, but it also contains a State Park. Within Fort Snelling State Park, there are many recreational activities available, including biking trials, walking trails, geo-caching, swimming, boating, and fishing. Some of the wildlife living in Fort Snelling State Park includes beavers, river otters, muskrats, white-tailed deer, red fox, and a wide array of bird species.

Fort Snelling State Park also houses a memorial site to the Dakota people who were kept in a prison camp there during the winter of 1862-1863.

A red fox in Fort Snelling State Park
Photo: Minnesota DNR

Questions:

- Have you ever been to a State Park? Have you visited Fort Snelling State Park?
- Do you think it would be fun or interesting place to visit with friends and family?
- How do you think Dakota people might feel about the *b'dote* area being both a state run park and state run historical site?

Dakota Prison Camp

Location: Fort Snelling

Facts: Dakota women and children were brought to a prison camp at the confluence during the winter of 1862-1863, following the Dakota Conflict. Some whites thought the camp was to keep the Dakota people safe from violent attack, but most Dakota people felt that it was a prison and concentration camp.

The internment camp at Pike Island.
Source:http://upload.wikimedia.org/wikipedia/commons/a/ab/Dakota-Interment-Pike_Island.jpg

Dakota men were brought to a camp in Mankato where some were hung. According to some sources, those who were executed were convicted of crimes. President Lincoln had sent a pardon for all the men sentenced to hang, except for those with strong evidence against them. Other Dakota sources say that these men were martyrs, and they were not criminals.

While there is some debate over what happened and why it happened, everyone agrees that in the winter of 1862-1863, the living conditions in the prison camps of Fort Snelling were of extreme hardship, brutality, and misery for the Dakota. **Question:** How do you think it would feel to be imprisoned in your homeland, in the very heart of sacred ground?

Wita Tanka: Pike Island

Location: River Mile 845.00-844.00, on the water, located between the confluences of the Mississippi and Minnesota Rivers

The photo above is an aerial shot showing the confluence, and the tip of Pike Island. Notice the difference between the muddy Minnesota River and the cleaner Mississippi River

Facts: Lt. Zebulon Pike was sent on an expedition up the Mississippi in 1805. He was given many assignments for the expedition, including finding the source of the river, mapping the river, detailing information on the Indian tribes he met, purchasing the best sites for military posts, and recording the weather.

Pike was not prepared for the exploration. When he reached the confluence, the negotiation proceedings with the Dakota were rushed. He convinced a few chiefs to sign away 100,000 acres of tribal lands, (including the strategic bluffs where Fort Snelling would be built) for $200 worth of trinkets. This agreement was problematic for several reasons. The Dakota chiefs did not have authority to give away this land, the negotiations should have been given some time and consideration, and Pike did not have Congressional approval to make this purchase. Despite these issues, Pike Island continues to bare his name. *Source: Severin, Timorthy. Explorers of the Mississippi, http://www.nps.gov/miss/historyculture/confluence.htm, FMR field guide*

Side Fact: Pike Island was used as a farmland in the 1950s, and once included a gladiola farm that supplied floral shops.

Questions:

- How do you think Dakota people feel about their spiritual homelands having been sold in a questionable manner?
- Can you imagine Pike Island as a flower farm? What kind of changes took place for the island to look wild again?
- Why do you think that the Dakota initially welcomed the Americans, and allowed them to build a fort in this important place?
- Do you think a treaty can be fair if the two sides have unequal power?

Sibley House

Location: Minnesota River mile 1.5 W, on the left bank ascending (traveling upstream) on the river.

Facts:
Construction of the Henry Sibley house began in 1838. It is significant because of its association with the American Fur Company, which Sibley was a manger of.

Between 1825 and 1853, The American Fur Company conducted regional trade with the Dakota. As time passed, the surrounding area changed from an isolated trading post to an organized territory, and eventually became part of the state in 1858. Four distinctive limestone buildings remain from what was once a bustling operation. Furs were collected and transported in canoes very similar to the canoes you are currently riding in. Now operated by the Minnesota Historical Society, this complex signifies The American Fur Company's role in the region's fur trade between 1825 and 1853, as well as Henry Sibley's role the first state's first governor, and as a general leading the war against the Dakota people. Source: http://www.nps.gov/miss/planyourvisit/siblhous.htm, http://www.mnhs.org/places/sites/shs/

Questions:

- Can you imagine traveling in this canoe as a voyageur?
- What would it be like to live and trade with Dakota for several months and then fight against them later in life?
- If you were faced had this job, how would you feel about it?

Oheyawahi or "The Hill Much Visited"
a.k.a. Pilot Knob

Location: Minnesota River mile 2W, high hill on the left ascending bank (traveling upstream) on the river.

Facts: Pilot Knob held significance for the Dakota. Here, overlooking the confluence, the Dakota buried their dead and conducted ceremonies. They also signed the Treaty of Mendota here in 1851, giving up their ancestral lands along the Mississippi River for a reservation on the Minnesota River.

River pilots also used this high hill as a landmark, effectively marking the start of the river gorge. The gorge was full of rushing rapids that could not be passed. Source: www.nps.gov/miss

Here is the view from Pilot Knob looking north towards Minneapolis. Historic Fort Snelling is in the middle ground.

Questions:

- Does your family have any special places you go to for important events?
- How did pilots navigate without GPS, and other electronics?
- What other landmarks can you think of in the area?

Highway 5 Bridge

Location: Just upstream of Pike Island and below Fort Snelling. (behind or upstream from where the trip starts)

Facts: This bridge is a good approximation for the size and height of the River Warren Falls. River Warren Falls was an enormous waterfall, which carved out this section of the river. Over thousands of years, the falls receded upstream from downtown St. Paul to their current location, where they became known as the St. Anthony Falls. This recession was caused by the collapse of the bedrock that supported the falls. Mississippi River bedrock is made of three layers of sedimentary stone: sandstone, limestone, and shale.

The soft sandstone erodes faster than the limestone and shale. As the sandstone eroded in the falls, the support of the upper two layers eroded as well, eventually leading to its collapse and migration upriver. This erosion is also what formed the Mississippi River Gorge. In some places along the river bluffs, you can view the layers of bedrock and boulders that have fallen into the water.

River Warren Falls, which may have looked like this one, created the Mississippi River Gorge.

Questions

- What would a waterfall look like if it were covering this area?
- Can you imagine a waterfall of this size roaring down, and collapsing its way upstream?

Floodplain Forest

Location: Throughout the river

Facts: Floodplain forestland is valuable to the river. The vegetation and microorganisms that live in these forests serve as water absorbing and filtering systems. Most of the vegetation along the river has been lost, but the remaining floodplain forest continues to fulfill an important role in improving water quality. Water that enters the river from a floodplain forest is much cleaner than water from storm sewers because it has gone through this filtering process.

The ability of forests to produce clean water declines as they are depleted or reduced in size. Thus, the loss of forestland seriously impairs water flow and quality, ecological health and diversity, and some economic and recreational water use. The Upper Mississippi River watershed experienced rapid loss of forestland in the late 1800s through the early 1900s. Since then, deforestation is

most common in high-growth areas. Trends in forest ownership show a continuing trend towards smaller tracts, which will likely have a negative impact on water quality.

Lowland deciduous forest habitats occur within floodplains like this one. Floodplain forests are seasonally wet forests; they flood in the spring after the snowmelt or after a heavy rain. These forests are found on sandy or silt-laden alluvium (fertile soil deposited by flowing water). These forested areas are an interface between terrestrial and aquatic ecosystems.

The canopy of floodplain forests are dominated by deciduous trees that are tolerant of saturated soils, prolonged inundation, frequent erosion, and sediment deposition. Less tolerant plants will grow on terraces, which flood only occasionally. In this area, silver maple, black willow, and cottonwood trees are the most dominant. Source: http://files.dnr.state.mn.us/assistance/nrplanning/bigpicture/cwcs/habitats/03.pdf

Questions:

- Do you think there was more forest land before humans arrived?
- How do you think modern human land-use, such as sewers and concrete have affected water quality?
- How can we work to improve water quality within the modern context?
- How does a forest “clean up” water and improve watershed health?
- Can a habitat be “restored” to its original condition?
- Why does the destruction of floodplain forest have an impact on birds?
- What are some ways to prevent destruction of floodplain forests?

I-35 E Bridge

Location: River Mile 843.30, on both banks, the first bridge you pass under on the trip

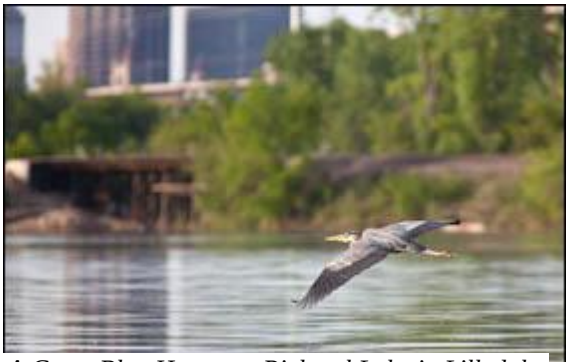
Facts: This highway bridge includes a separate bicycle path connecting the trail systems on either side of the river. Upstream of this bridge, there is a good view of the different sedimentary rock layers.

Questions:

- Have you ever crossed this bridge?
- How does it feel passing under it?
- What do you think comes off the bridge and into the river, and how does this affect the water quality of the river?

Lillydale Regional Park

Location: River Mile 843.00-840.50, right descending bank



A Great Blue Heron on Pickerel Lake in Lillydale

Facts: The village of Lillydale once occupied the east bank floodplain of the Mississippi River, but this location subjected the town to repeated flooding and eventually the town relocated to the bluffs above the floodplain. Now, the land has been turned into a regional park.

The park retains the name of Lillydale, named for the abundance of lilypads that dot the surface of Pickerel Lake during the summer. The village of Lillydale was located between Water Street, and the hill to Highway 13 at the upstream, and was bracketed by the river and Pickerel Lake. It was a village of several dozen homes and a one-room schoolhouse. Today, Lillydale Regional Park offers superb level-ground biking and hiking through the woods along the river from the Mendota area to Harriet Island. Part of the Big Rivers Bike trail is found in Lillydale Regional Park, and a railroad runs below the bike trail.

Questions:

- How do you think the changing land-use in Lillydale, from a village into a park, affected water quality?

St. Paul Brickyard and Caves

Location: River Mile 841.00, right descending bank, across the river from Island Station. Located in Lillydale Regional Park.

Facts: This brickyard was the site of the Twin Cities Brick Company, which was founded in 1894. The company continued to make bricks here until the 1970s. The interest in brick making boomed after a number of local villages and cities, constructed primarily of wood, burned during catastrophic fires in the late 1800s.

If you walk around this area, you will find broken bricks scattered about. The bricks were made from the clay and shale found here. The "MBC" mark imprinted on a brick indicates that it was created at this site.

The caves found here are old mines and they are all man made. The caves have been used as storage for business, breweries, and places to grow mushrooms. The caves are also home to bats. Please do not enter the caves because they are unstable and dangerous.

Also of note at this area is the limestone. This limestone, which is actually prehistoric seabed, is rich in fossils. You can hunt for fossils here if you have permission. Permits for fossil hunting can be had from the St. Paul Parks Department from mid April to October or you can go on a ranger-led fossil hunt. Source:

http://fieldguide.fmr.org/site_detail.php?site_id=228, Lillydale Park-fossil hunting packet, http://www.stpaul.gov/index.aspx?NID=1560

Questions:

- Are you ever inside of brick buildings?
- What do you think about a brick yard on the river?
- Have you ever hunted for fossils?
- Have you ever seen a bat? Do you know what bats eat?

Kittsondale Sewer

Location: River Mile 841.90, left descending bank

Facts: The Kittsondale Sewer discharges to the river at Bay Street. This major storm water sewer drains water from streets as far away as the Snelling and the University Midway area.

The sewer is known as the Kittsondale Sewer, and was named after Minnesota entrepreneur Norman Kittson. The sewer includes a deep shaft that drops water from the height of the bluff to the level of the river. Water falling that far would quickly erode the sewer brick and cement, so a “stair- step flight” sewer was constructed. This is a 20-foot diameter, 100-foot deep spiral stairway, which lowers the water as it flows down the spiral. The flight sewer spiral is at the location of the former Cascade Creek waterfall, and captures the flow of the former Cascade Creek.

Source: http://fieldguide.fmr.org/site_detail.php?site_id=217

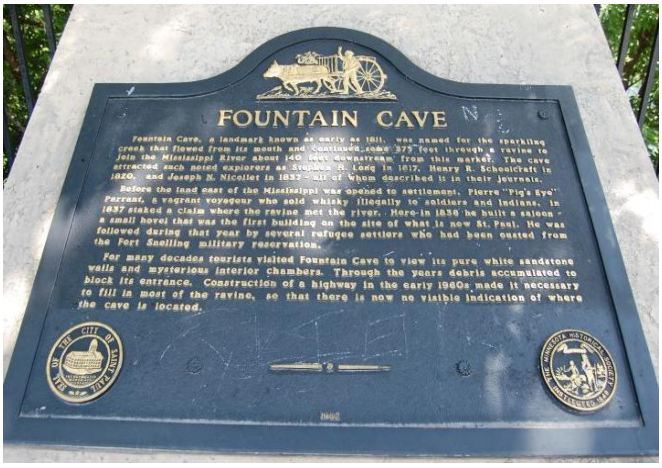
Questions:

- What is in the water that is discharged from this sewer?
- How does the discharge, nutrients, sediment, and chemicals it carries affect the river’s water quality and the plants and animals that live in the river?
- Could drains like these affect the Gulf of Mexico’s water quality?

Fountain Cave

Location: River Mile 841.60, left descending bank

Note: Fountain Cave's entrance was buried by the construction of Shepard Road in 1960. The entrance is neither evident nor accessible; all that remain is a cove near a storm sewer, and a historical sign marking the location which can be seen from Shepard Road.



Facts: Long known to the local Dakota as IN-YAN TI-PI, Fountain Cave was the first building site for what was to become the city of St. Paul. Pierre (Pig's Eye) Parrant, a person of dubious reputation, built a cabin at the mouth of the cave in 1838. Parrant was evicted two years later by the military authorities at Fort Snelling.

After Pig's Eye's departure, the cave was used as a storehouse, and later as a tourist attraction from 1850-1880. St. Paul residents visited the cave for its cool air and water. As the cave's popularity increased, a pavilion was opened nearby in 1852, which offered refreshments and lights for exploring the cave. Fountain Cave was even featured in the *Tourists' Guide to the Health and Pleasure Resorts of the Golden Northwest*.

There were many human activities that led to the deterioration of Fountain Cave. In the late 1800's, sewage and storm water were discharged through the cave by a railroad facility, which reduced the cave's value as a tourist attraction. Nearby residential development altered the area's hydrology by filling in the wetlands and slowing the flow of Fountain Creek into the cave. Finally, in 1960, the cave's entrance was buried during the construction of Shepard Road.

Fountain Cave was estimated to have been 1,150 feet in length, and was possibly Minnesota's longest natural sandstone cave. The formation of the cave was a result of erosion. As stream water made its way to the Mississippi, the sandstone wore away. Inside the cave, a 150-foot-long winding hall led to a beautiful circular room about 50 feet in diameter.

Questions:

- How do you think historical uses, such as dumping raw sewage into the river, affect water quality?
- Do you think water quality has improved since we stopped this practice?
- Can humans make positive changes for the environment?

Barton-Omaha Flats Neighborhood

Location: River Mile 841.70, left-descending bank, between Fountain Cave and the swing bridge

Facts: This historical neighborhood consists of a dozen homes up against the cliff and some above the cliff. Each cliff-house had its own cave for storage and some foundation remnants can still be seen. The Flats neighborhood was in existence until 1950, and had no sewer or water service.

Questions:

- How would a community with no sewage or water connections affect the water quality of the river?

Swing Bridge

Location: River Mile 841.40, on both banks

Facts: The Union Pacific (formerly Chicago Northwestern) Railway Bridge has a 22.3-foot clearance. For towboats and larger recreational craft, the bridge tender swings the bridge open and closed. Note the counterweight that balances the track span. Swing bridges are faster than draw-bridges; thus, they were used on routes with heavier traffic.

This is actua
Island Swing
demonstrates
work.

Island Power Plant & "Third World Marina"

Location: River Mile 841.10, left Descending Bank

Facts: This 1923 power plant, formerly operated by Northern States Power, has been the subject of numerous development plans and schemes, and also has been the home to squatters, artists, boaters, and renters. The plant is now owned by John Kerwin, through Nicollet Restoration, Inc.. There is talk of this becoming the future home of the MNRRA visitor center, but at this stage it is only talk.

Questions:

- What would you do with old buildings like this one?
- How do you think old buildings like this one affect water quality?

Excel Energy High Bridge Power Plant

Location: River Mile 840.80, left descending bank

Facts: Excel Energy owns and operates this plant. In 2008, they upgraded from a coal burning plant to a natural gas burning plant. This has created a more efficient plant and cleaner plant. The conversion of High Bridge from coal to natural gas significantly reduced all air emissions from the plant- particulates by about 92%. Nitrogen oxide was reduced by almost 97%, sulfur dioxide by 99% and 100% of mercury emissions were eliminated. This plant will produce 600,000 megawatts of power, more than double the capacity of the old plant.
Source: http://minnesota.publicradio.org/display/web/2008/02/18/xcel/

Although they generally have become much cleaner because of new laws, many other power plants still emit carbon dioxide (which contributes to global warming), hydrogen sulfide (which can lead to acid rain), and mercury (which is toxic and bioaccumulative in animals and humans).

Question:

- How can power plant emissions affect water and air quality?
- Why/Do you care about water and air quality?
- What can you do to help?

Ospreys and Osprey Nest

Location: Osprey nest, on left descending bank past the Xcel Energy plant.

Facts: As one of the largest birds of prey in North America, the Osprey lives along waterways like this one. It is one of the most widespread birds in the world, and is found on all continents except Antarctica. The Osprey readily builds its nest on manmade structures, such as telephone poles, channel markers, duck blinds, and nest platforms designed especially for it. Such platforms have become an important tool in reestablishing Ospreys in areas where they had disappeared. In some areas, Ospreys are found nesting only on artificial structures.

Osprey eggs do not hatch all at once, but instead the first chick hatches up to five days before the last one. The older chick dominates its younger siblings, and can monopolize food brought by the parents. If food is abundant, little aggression is seen amongst the chicks. If food is limited, the younger chicks often starve.

The Osprey is a fish-eating specialist, with live fish accounting for about 99% of its diet. Barbed pads on the soles of its feet help it grip slippery fish. When an Osprey takes a large fish to its nest, it carries the fish headfirst to make it as aerodynamic as possible.
Source: http://www.allaboutbirds.org/guide/Osprey/lifehistory

Questions:

- How do you feel when you see large raptors?
- What do you think about the recovery of some large raptor species in the cities?

The Smith Avenue High Bridge

Location: River Mile 840.50, on both banks

Facts: The bridge is named for Smith Avenue, which is named for Robert A. Smith, who was a multi-term mayor of St.Paul (Upham, Warren. p. 613). The bridge, also called the High Bridge, is 224 feet above the water and 2,717 feet long (Twin Cities MHS. p. 14). One of the not-to-be-missed Metro Mississippi adventures is a walk over the bridge on the upstream sidewalk, and then a return walk on the downstream side sidewalk. The views of the gorge and downtown St. Paul are spectacular.

On the northern end of the bridge is a small park with a view of the power plant and the new Upper Landing development. This park also features a stone and steel crescent sculpture and a giant green chair. On the south end of the bridge is another small park with an overlook of Harriet Island and downtown St. Paul. From there, follow Cherokee downriver to Ohio Street to go down the bluff to Harriet Island.

Questions:

- Which bridge have you liked best today?
- What do you think about the visual impact of bridges?
- How do you think bridge traffic affects water quality?

Head House and Sack House

Location: River Mile 840.00, left descending bank

Facts: Head houses are places where grain is loaded onto barges, and sack houses are places were grain is put into sacks. In the late 1800's Minneapolis millers and grain merchants, such as Cargill and Peavey, had control over grain marketing in the Midwest. But farmers resented the control the merchants had over grain prices, and their lack of alternative markets. This head house and stack house were built by the Equity Cooperative Exchange, which was formed by farmers in 1911 to provide an alternative to the Minneapolis grain market.

The Equity built grain elevators on the Upper Levee in 1915. However, low river levels and cheap grain shipping through the new Panama Canal made Mississippi River traffic almost disappear. Farmers fought back and pushed for improved navigation on the river.

The Minnesota Farmers Union took over the Equity Cooperative and pressed the government to dredge and maintain a 9-foot-deep navigation channel to allow reliable grain shipment out of the Midwest. They were successful. The Farmers Union, under the direction of George Lambert, expanded the elevators on the Upper Levee in

1927-31, and persuaded Congress to fund the 9-foot channel in 1930.

The head house and the sack house complex eventually included 90 grain silos, a mill, the tall head house for loading grain onto barges, and the sack house where grain was put into bags. The six-story head house and the one-story sack house remain. They have been the subjects of architectural and design contests to decide the future use of these relics of past shipping and mark

Harriet Island Park

Location: River Mile 840 right descending bank.

Facts: This route will likely involve take out at Raspberry Island, located in the middle of the river below the high bridge and right across from Harriet Island Park.

Harriet Island was named after pioneer school teacher Harriet Bishop. In 1900, Harriet Island was given to the citizens of St. Paul by Dr. Justus Ohage. He wanted to provide St. Paul with a recreational area that would benefit the public. Over the years, Harriet Island was home to many attractions including a complete outdoor gymnasium, a center pavilion for refreshments and bands, swimming lessons, slides, water games, and St. Paul's first zoo.

From 1910-1915, Harriet Island offered free public baths, bringing some 15,000 people to the beach every year. As pollution of the river increased, the popularity of the baths decreased.

In the 1920s an entrance was added to Harriet Island to increase accessibility at the south end of the Wabasha Street Bridge. However, by that time the park's heyday had passed. The Harriet Island public park was unappreciated despite its central location in the Twin Cities and more construction was attempted in 1929. A wide drive (Ohage Mall) was built around the island, and some trees and shrubs were planted. Unfortunately, the onset of the depression prevented any further development.

In the early 1950s, the water channel connecting the park to the mainland was filled creating today's Harriet Island.

In 1969, expansion of Harriet Island was again considered. The idea was dismissed because there was still a large amount of river pollution in the area, which was unappealing to visitors. Source: http://www.nps.gov/miss/planyourvisit/harrisla.htm

Questions:

- Do you enjoy having public parks, like Harriet Island, where you can go, as opposed to only have private land on the river?
- Do you think this parkland would exist if people hadn't acted in the past?
- How do you think parkland affects water quality?